USERS MANUAL FOR MOBILE APPLICATIONS

GENVERTER W-GV4

Variable speed: 2500-3400 RPM
230V / 50Hz

Art.nr. 40200671

WHISPER POWER BV
Kelvinlaan 82
9207 JB Drachten
The Netherlands
Tel.: +31-512-571550
Fax.: +31-512-571599
www.whisperpower.eu

V1 December 2010

CONTENTS:

1.1 General 4
1.2 Service and maintenance 4
1.3 Guarantee 4
1.4 Liability 5
1.5 Identification 5
1.5.1 General 5
1.5.2 Identification plate 5

1 INFORMATION 6
2.1 Safety 6
2.1.1 Warnings and symbols 6
2.1.2 General 6
2.1.3 Organizational measures 7
2.1.4 Maintenance & repair 7
2.1.5 Electrical safety 7
2.1.6 Earth insulation failures 7
2.1.7 Installation 7
2.1.8 Operation 8
2.1.9 Fire and explosion 8
2.1.10 Chemicals 8
2.1.11 Warning regarding life support applications 9
2.2 Transport, lifting and storage 9
2.3 Features 9
2.3.1 General 9
2.3.2 Construction 9
2.3.3 Control 9
2.3.4 Installation 9
2.3.5 Documentation 9
2.4 Main components to identify 10

3 TECHNICAL INFORMATION 11
3.1 Explanation functional parts 11
3.1.1 Control system 11
3.1.2 Remote control panel 11
3.1.3 AC Permanent Magnet Alternator 12
3.1.4 Inverter 12
3.1.5 Engine 12
3.1.6 Battery charger 12
3.1.7 Alarms and shut down 12
3.1.8 Control 12
3.1.9 Remote control panel 12
3.1.10 Hour counter 12
3.1.11 Load indicator 13
3.1.12 Fuel 13
3.1.13 Bio-diesel 13
3.1.14 W-GV4 oil cooler 13
3.1.15 Oil information 13
3.2 Technical data 15
3.2.1 General 15
3.2.2 Alternator 15
3.2.3 Inverter 15
3.2.4 Mechanical specifications 15

3.2.1 Electrical diagrams 16
3.2.6 Lay out connections 18

4 OPERATION 19
4.1 General 19
4.2 Operation modes to be set 19
4.3 Operating Instructions 19
4.3.1 Summarised operating instructions (daily use) 19
4.3.2 Extended operating instructions 19

5 MAINTENANCE 22
5.1 Alternator 22
5.2 Engine 22
5.2.1 Preliminary instructions 22
5.2.2 Bleeding fuel lines 22
5.2.3 Valve clearance 22
5.2.4 Replacing fuel filter 22
5.2.5 Cleaning oil strainer 22
5.2.6 Air filter element 22
5.3 Regular maintenance 22
5.3.1 Maintenance schedule 23
5.3.2 Putting out of service 23

6 TROUBLE SHOOTING 24
6.1 GENERAL 24
6.1.1 Failure codes 24
6.2 Alternator/ electrical faults 24
6.2.1 Trouble shooting table inverter /alternator 25
6.2 Engine faults 25
6.2.1 General 25
6.2.2 Trouble shooting table engine 25
6.2.3 Warnings 28
6.2.4 Service address 28
6.3 Special procedures engine 29
6.3.1 Standard torque chart 29
6.3.2 Adjusting valve clearance and retightening the cylinder head bolts 29
6.3.3 Tightening torques: 29
6.3.4 Valve clearance 29
6.4 Disassembly instructions 30

7 SPARE PARTS LIST 31

MAINTENANCE LOG 32

EC Declaration of Conformity/Incorporation

1 INTRODUCTION

1.1 GENERAL

The W-GV4 Genverter basic is manufactured and marketed by Whisper Power.
This manual serves as a guideline for the safe and effective operation, maintenance and possible correction of minor malfunctions of the genverter .

It is therefore obligatory that every person who works on or with the W-GV4 must be completely familiar with the contents of this manual, and that he/she carefully follows the instructions contained herein.. Both safety and durability rely very much on the correct identification, installation and a good understanding of ratings, features, design, maintenance and operation procedures.
The information, specifications, illustrations and statements contained within this publication are given with our best intentions and are believed to be correct at the time of going to press.

All of the specifications, provisions and instructions contained in this manual apply solely to standard versions of the W-GV4 variable speed genverter for mobile applications, first launched in January 2011
This manual is valid for the following models:

Part number	Model name
41002000	W-GV4, 50 Hz 230V

For other models see other manuals available on our website: www.whisperpower.eu

Our policy is one of continued development and we re-serve the right to amend any technical information without prior notice.
Whilst every effort is made to ensure the accuracy of the particulars contained within this publication neither the manufacturer, distributor, or dealer in any circumstances shall be held liable for any inaccuracy or the consequences thereof.

DANGER
Be aware that people are not used to have 230V available on a vehicle. Put warning signs on wall sockets and on junction boxes. Instruct non-regular users of the vehicle. Warn maintenance personal of garages that do service on the vehicle.

1.2 SERVICE AND MAINTENANCE

Regular service and maintenance should be carried out according to the directions in this manual. For service and maintenance one can appeal to the manufacturer or the dealers.

1.3 GUARANTEE

Whisper Power guarantees that this genverter has been built according to good workmanship, according to the specifications in this manual and according to European Community safety regulations.
During production and prior to delivery, all of our Genverters are tested and inspected.

The well functioning of this genverter is subject to guarantee. The period and conditions of this guarantee are laid down in the general conditions of delivery as registered with the Chamber of Commerce and Industries for the North of the Netherlands number 01120025 and are available on request. The guarantee period is two years, limited to 1000 running hours. Some aspects of our guarantee scheme are given here in more detail:

Guarantee does not cover failures that are caused by misuse, neglect or a faulty installation.

Example 1. Faulty installation:
Overheating of the engine or alternator is the most common cause of problems with mobile Genverters. These problems are caused by hot air circulation into the radiator and the radiator fan sucking exhaust gasses into the radiators or into the inverter box.
The Genverter and other parts should be protected against the influences of the weather and splashing water (with dirt and salt) below the vehicle. Refer to the installation manual for instructions but remember these are for guidance only as many factors influence the installation of a Genverter. The ultimate responsibility will always be with the owner to ensure a safe and compliant installation. If in doubt ask!

Example 2: Misuse:
Long term running with no load or too little load can cause the exhaust to get choked with soot or carbon. Cleaning the exhaust is not covered by guarantee.

Example 3: Neglect
A Whisper genverter has an option for an auto start/stop mode or interval mode.
Whisper Power cannot be held responsible for damage caused by the unattended running Genverter.

Oil changes must be carried out according to the maintenance schedule.

Guarantee means that faulty parts are repaired or replaced free of charge. If necessary the whole Genverter unit will be exchanged. Labour necessary to complete repairs on board a vehicle executed by an authorized service engineer is covered, but is limited to a reasonable number of hours and reasonable rates in relation to the actual repair work that has to be done.
Travel expenses and travel hours are not covered. Also not covered is the labour required to take a Genverter out of a vehicle or for reinstallation. There is no cover for labour needed to get access to the Genverter, for example to remove equipment or parts of the vehicle body etc.

Goods to be delivered under guarantee will be invoiced. Only after the faulty goods are returned will the invoice be credited. Payment in advance may be required or guaranteed by credit card. If after the faulty goods are returned, it is indicated that the failure was not covered by guarantee a credit will not be issued. For example if a Printed Circuit Board is returned with clear damage caused by water, guarantee will be refused.
Freight costs to deliver spares by normal mail or carriers is covered under guarantee. Special services like express mail, overnight delivery etc. are not covered. Taxes and duties are not covered. For shipments to remote areas any additional costs incurred over normal carriage will be invoiced to the customer.
The cost for returning faulty goods is not covered under guarantee.

If any problem arises which could be subject of guarantee, procedures should be followed as described in the guarantee conditions, unauthorised repairs could lead to further damage and violate the guarantee conditions.

Should work take place, which is not in accordance with the guidelines, instructions and specifications contained in this user's manual and the supplementary installation manual, then damage may occur and the Genverter may not fulfil its specifications. In all these cases the guarantee may become invalid. Use original spare parts only!

1.4 LIABILITY

Whisper Power does not accept responsibility for damage, injuries or casualties which are the result of operation of the Genverter in specific conditions which brings dangers which could not be foreseen, or could be avoided by additional measures. Whisper Power does not accept liability for damage due to use of the Genverter, possible errors in the manuals and the results thereof.

Automatic start/stop
Whisper Power cannot be held responsible for damage caused by the unattended running genverter using the auto-start/stop mode or interval mode.

Do not use the Genverter when the vehicle is inside a building or in other enclosed area's. Be aware using the Genverter in wind still conditions, when the exhaust fumes could accumulate under, around or even in the vehicle.

SWITCH OFF THE GENVERTER WHEN THE VEHICLE IS INSIDE BUILDINGS OR IN ENCLOSED AREAS.

1.5 IDENTIFICATION

1.5.1 General

Before using this genverter it is very important to identify the model correctly. To communicate for service or ordering parts it is also essential to correctly identify the genverter. Also for the daily operation of the Genverter it is necessary that the operator knows the correct specifications.

1.5.2 Identification plate

All required identification data are on the identification plate. For location of the identification plate see figure 1

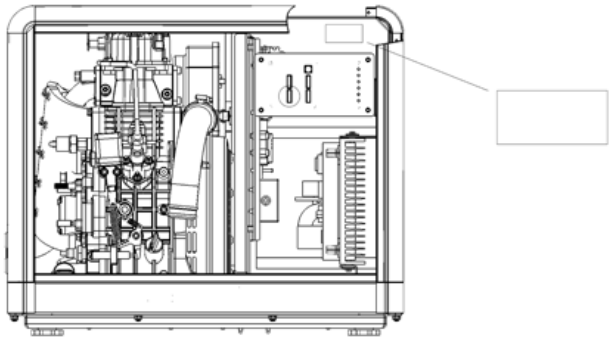


Fig. 1: Location identification plate.

1 The identity of the Genverter is given by the SERIAL NUMBER.
When this number is available the manufacturer can trace the specifications of the Genverter. On the

identification plate are also some basic features of the Genverter:

2 POWER
The identification plate gives the maximum load in kVA (= kW) calculated with power factor one. When calculating a load one should always take into account the power factor or cos. phi of this load. The load should never exceed the nominal power as shown on the identification plate. Power is rated at an ambient temperature of 25ºC. For higher temperatures the Genverter has to be de-rated. To drive the radiator fan (12V fan) output could be taken from power generated by the genverter. In that case net power could be less than specified on the identification plate.

3 VOLTAGE shows the nominal voltage: 230 V. The voltage is determined by the inverter. The alternator itself generates a variable voltage between 250V and 400V.

4 FREQUENCY is shown in Hz and is **not** determined by the speed of the engine as this is a variable peed generator. The frequency is determined by the inverter and is very stable (± 0.1 %).

5 CURRENT shows the maximum current that is acceptable at the specified frequency, voltage and power factor.

6 DC Voltage is the voltage of the starter battery.

7 WEIGHT shows the net dry weight (approximately) in kg. This is without fuel, oil, cooling liquid, packing and external installation equipment

8 CE-marking: the “CE” symbol shows that the Genverter is build according to European Community safety regulations. This includes the regulations regarding electric safety and electric magnetic compatibility (EMC) and other relevant directives. Regarding the Machinery Directive the genverter is an incomplete machine and can only comply after installation. Refer to the Declaration included in this manual. As the inverter works completely independent from the vehicles drive system and should not be connected in any way, an E-mark is not required.

Safety also relies on the installation, application and circumstances. See also the remarks in this manual under SAFETY

Before changing a factory setting you are advised to consult the manufacturer. When the Genverter you have to identify is not new you have to take into account the possibility that former users may have changed the settings. Check the settings when there is any doubt.

1 INFORMATION

2.1 SAFETY

2.1.1 Warnings and symbols

Safety instructions and warnings are marked in this manual by the following pictograms:

WARNING
This warning symbol draws attention to special warnings, instructions or procedures which, if not strictly observed, may result in damage or destruction of equipment, severe personal injury or loss of life.

WARNING
Moving machinery. This symbol indicates that a potential hazard exists caused by moving parts and draws attention to special warnings, instructions or procedures which, if not strictly observed, may result in severe personal injury or loss of life

WARNING
This danger symbol refers to toxic danger caused by Carbon monoxide (CO) and draws attention to special warnings, instructions or procedures which, if not strictly observed, may result in severe personal injury or loss of life.

DANGER
This danger symbol refers to electric danger and draws attention to special warnings, instructions or procedures which, if not strictly observed, may result in electrical shock which will result in severe personal injury or loss of life.

A procedure, circumstance, etc which deserves extra attention.

2.1.2 General

When correctly installed and used in normal circumstances this genverter fulfils EC safety regulations.

This Genverter could be part of an installation or could be used in a way that additional regulations of the EC or other authorities have to be taken into account. Refer to the declaration of conformity/incorporation included in this manual.

Circumstances could make it also necessary to take additional measures. Be aware of wet conditions and hazardous environments caused by explosive gases etc

2.1.3 Organizational measures

The user must always:
have access to the user's manual;
be familiar with the contents of this manual. This applies in particular to this chapter, Safety Guidelines and Measures.

2.1.4 Maintenance & repair

WARNING
When service has to be carried out while the engine is running, be aware of moving parts.

If the W-GV4 is switched off during maintenance and/or repair activities, it should be secured against unexpected and unintentional switching on:

- remove the AC supply
- remove the connection to the batteries
- be sure that third parties cannot reverse the measures taken.

If maintenance and repairs are required, use original spare parts only.
Always consult the manual before carrying out maintenance.

2.1.5 Electrical safety

Warning signs indicate parts which could be live.

The alternator output (which is the inverter input) can be as high as 400 Volt and is very dangerous. The only way to get access to the high voltage parts is with the help of tools. One should never run the genverter when there is access to these parts. Contact to this parts may result in electrical shock which will result in severe personal injury or loss of life.

Also the 230 Volt generated by the Genverter is dangerous and if instructions and procedures are not strictly observed may result in electrical shock which will result in severe personal injury or loss of life.

Be aware that people are not used to have 230V available on a vehicle. Put warning signs on wall sockets and on junction boxes. Instruct non-regular users of the vehicle. Warn maintenance personal of garages that do service on the vehicle.

- Check all wiring at least once a year. Defects, such as loose connections, burned cables etc. must be repaired immediately.

- Do not work on the electrical system if it is still connected to a current source. Only allow changes in your electrical system to be carried out by qualified electricians.

- Connection and protection must be done in accordance with local standards.

2.1.6 Earth insulation failures

According to local regulations and depending on the application it could be necessary to take measures for protection against earth insulation failures.
In the standard delivery “neutral” and “ground” are not connected. To make a connection between “neutral” and “ground” could be necessary as part of a specific insulation failure protection system.

In all situations the transfer switches between shore and genverter should switch both neutral and L1.

2.1.7 Installation

Whisper Power Genverters are not self contained and have to be properly installed in enclosed areas. Installation includes measures to be taken to outlet exhaust fumes which contain carbon monoxide and are extremely dangerous. Carbon monoxide (CO) is an invisible odourless gas. Inhalation produces headache, nausea or death. Installation includes measures for proper ventilation, safe electric connections, safe installation of the starting battery, proper fitting of the cooling system and fuel pipes etc. Refer to the installation manual.

Do not use the Genverter when the vehicle is inside a building or in other enclosed area’s. Be aware using the Genverter in wind still conditions, when the exhaust fumes could accumulate under, around or even in the vehicle.

2.1.8 Operation

There are no external moving parts like fans and V-belts The fan of the radiator unit is covered by a grid . The hot parts of the engine covered by the sound shield and therefore the W-GV4 is very safe when the sound shield is closed.

Nevertheless take note of the signs on the Genverter which show symbols in a triangle indicating danger.

- The Genverter should be operated by authorised personnel only.
- Be aware of hot parts and especially parts of the exhaust system and the cooling system.
- If the Genverter is unsafe, fit danger notices and disconnect the battery positive (+) lead so that it cannot be started until the condition is corrected.
- Do not attempt to operate the Genverter with a known unsafe condition. Disconnect the battery positive (+) lead prior to attempting any repairs or cleaning inside the enclosure.
- Always consult the manual before carrying out maintenance.
- Do not change the settings without consulting the manufacturer. Keep a record of setting changes in this manual.

2.1.9 Fire and explosion

Fuels can be flammable. Proper handling limits the risk of fire and explosion.

WARNING
Never use the W-GV4 in situations where there is danger of gas or dust explosion or potentially flammable products!

- Avoid refilling the fuel tank while the engine is running. When oil or fuel is leaking do not use the Genverter.
- Hydrogen gas generated by charging batteries is explosive. Ensure for proper ventilation. Do not smoke or allow sparks, flames, or other sources of ignition around batteries.
- Keep a fire extinguisher on hand.

Fig. 2: Fire extinguisher port.

- In case of fire do not open the sound shield. To avoid serious injury or death from fire, shut down engines, generator sets and blowers. Break through the label which is indicated by BREAK THROUGH HERE and then immediately discharge entire contents of gaseous portable fire extinguisher through the fire extinguisher port. On the Genverter this fire extinguisher port is indicated by the label as shown in figure 2.
- Poor electrical connections or using wiring which is not suited for the rated currents can cause overheating and possibly fire.

2.1.10 Chemicals

- Fuels, oils, coolants, and battery electrolyte can be hazardous to personnel if not treated properly. Do not swallow or have skin contact with these liquids. Do not wear clothing that has been contaminated by fuel or lubricating oil.
- The gaskets used in the Genverter are free of asbestos. Still in general gaskets may be made from asbestos. Particles of this material should not be inhaled as this may result in fatal diseases. Therefore it is a good habit to be careful with gaskets.
- On no account allow any unprotected skin to come into contact with the injector spray as the fuel may enter the blood stream with fatal results.
- Engines may be fitted with seals or O-rings manufactured from "Viton" or similar material.
  When exposed to abnormal high temperatures in excess of 400°C an extremely corrosive acid is produced which cannot be removed from the skin. If signs of decomposition are evident, or if in doubt, always wear disposable heavy duty gloves.

2.1.11 Warning regarding life support applications

The W-GV4 is not sold for applications in any medical equipment intended for use as a component of any life support system unless a specific written agreement pertaining to such intended use is executed between the manufacturer and Whisper Power. Such agreement will require the equipment manufacturer either to contract additional reliability testing of the W-GV4 and/or to commit to undertake such testing as a part of the manufacturing process. In addition the manufacturer must agree to indemnify and not hold Whisper Power responsible for any claims arising from the use of the W-GV4 in the life support equipment.

2.2 TRANSPORT, LIFTING AND STORAGE

When lifting the Genverter avoid any risk of personal injuries, do not stand under the Genverter.

- Use soft slings to avoid damage
- On the engine is a lifting hoist eye which can be used to take the Genverter out of the capsule. It can also be used to lift the complete Genverter including the capsule.
- After transporting the Genverter check for damage before installation.
- Long term storage can have detrimental effects on engine and alternator. The engine should be put through an engine preservation procedure. (Refer to the maintenance chapter)
- The alternator windings tend to condense. To minimise condensation, store the Genverter in a dry and warm storage area.
- While the battery is stored it should be recharged every 12 weeks.

2.3 FEATURES

2.3.1 General

The WhisperPower genverter combines a small oil cooled diesel engine, a Permanent Magnet alternator and an Inverter, making variable speed possible. Variable speed means that the engine will operate at low rpm (2500 rpm) when little power is needed and at high speed up to 3400 rpm when a high output is demanded. Because of variable speed the unit operates much more economic (less fuel consumption), the life time is much longer than generators that runs constantly at high speed and the noise is much lower when running at low speed. Lower fuel consumption also means less CO2 emission.

2.3.2 Construction

The genverter incorporates a diesel engine which has an permanent magnet alternator in the flywheel. The engine is mounted on a steel base frame and mounted securely on a double set of anti vibration mounting pads in a sound attenuated canopy. The output of the power from the alternator will be about 300V-400Hz and 400V-500Hz, depending on the engine speed. The inverter will invert this output to 230V 50Hz. The inverter is in a separate compartment of the canopy, or could be mounted separately in an other space (not standard).
The engine can adapt the speed automatically to the load applied. It is also possible to set a speed when running at fixed speed. This could be more comfortable when a constant load is applied or for service.
All cables and hoses are guided through the capsule's sides.

2.3.3 Control

The Digital Control system of the genverter is based on microprocessor technology. Several operation modes and automatic start/stop functions can be programmed and monitored (refer to Digital Diesel Control users manual).
The full automatic remote control panel including 15 meter cable comes as standard with the genverter.

2.3.4 Installation

The genverter is not self contained and is only operable after proper installation using additional accessories and installation materials such as a starter battery, fuel supply and an exhaust system.
Installation accessories are listed in the installation manual and are available through the supplier of the genverter.

2.3.5 Documentation

Included in the delivery are:

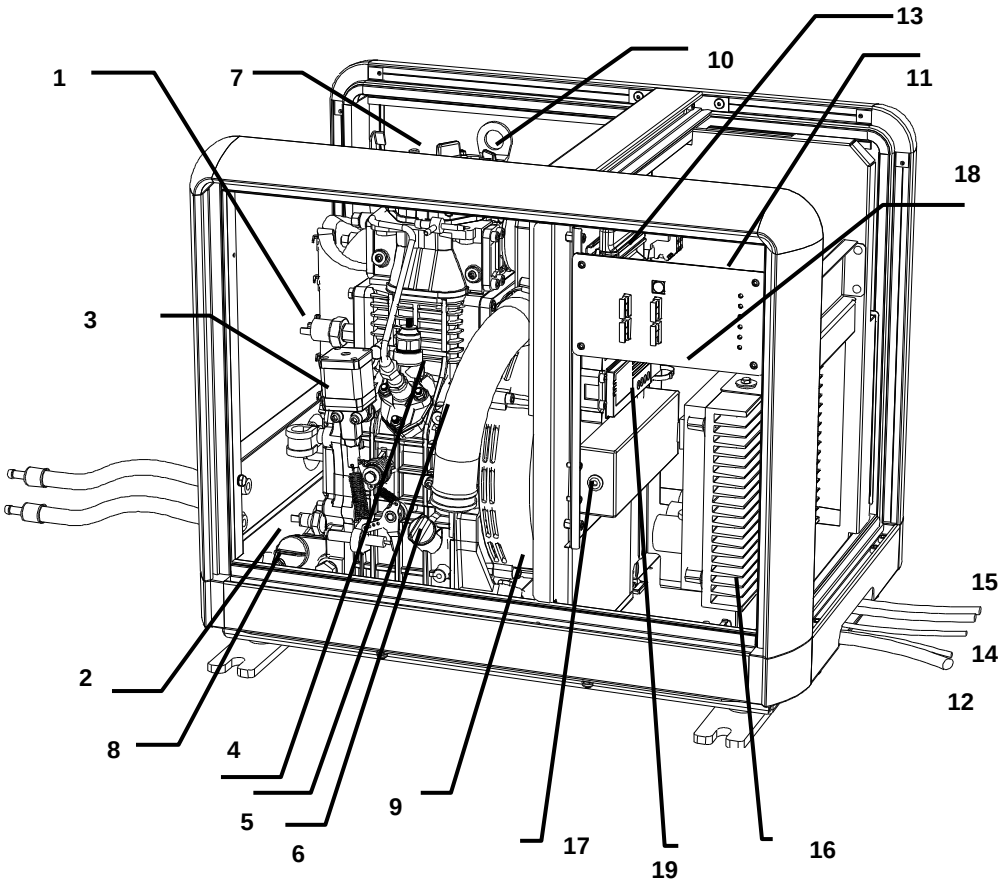
- This users manual (number: 40200671)
- An installation manual (number: 40200681)
- A operational manual for DCC (number: 40200801).
- A quick reference guide for DDC (number 40200142)

Manuals in other languages are available on request.
Not included in the standard delivery but available as options are:

- Parts manual: number 40200144
- Workshop manual; number: 40200146

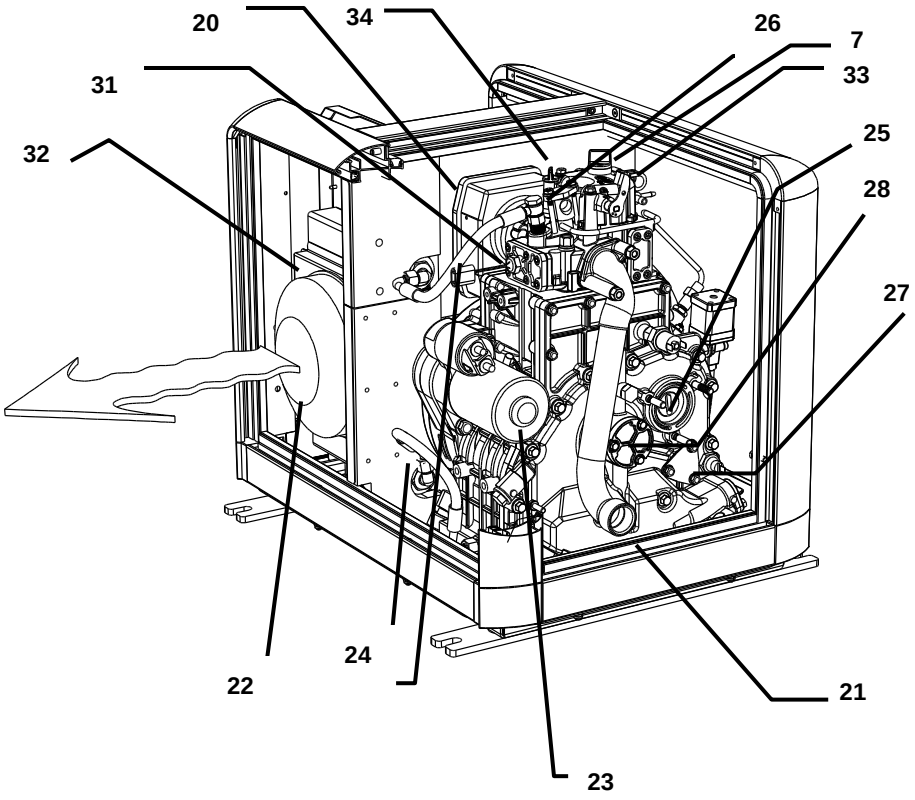
However in this manual there is a list of important parts for maintenance and spare parts as well as a chapter on maintenance and problem solving.

2.4 MAIN COMPONENTS TO IDENTIFY



1 Cooling oil pressure switch
2 Lube oil pressure switch
3 Actuator electronic governor
4 Fuel injection pump +stop valve
5 Air inlet
6 Oil filler cap / oil level indicator
7 Additional oil filler cap
8 Oil strainer
9 Permanent magnet alternator
10 Lifting eye
11 Identification plate
12 AC Outlet cable
13 Interface unit
14 DDC remote communication cable
15 Battery cables
16 Inverter
17 Battery charger unit 12 V
18 Control panel
19 DDC unit

Fig. 3: Service side view main components



7 Additional Oil filler cap
20 Air cleaner element
21 Exhaust outlet
22 Cooling fan power electronics/ Air flow direction
23 Starter motor
24 Cooling oil pipes
25 PTO shaft
26 Injector
27 Lubrication oil pump
28 Cooling oil pump
29 Fuel lift pump
30 Fuel filter
31 Temperature sensor
32 Radiator oil cooler
33 Decompression handle
34 Cold start oil cap

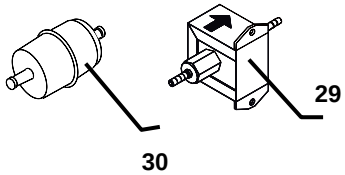


Fig. 4: Back side view main components

3 TECHNICAL INFORMATION

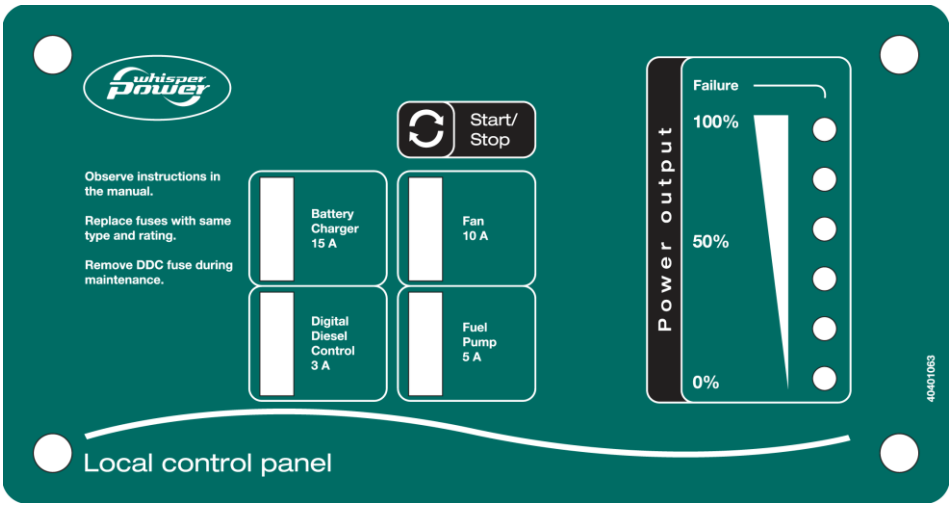


Fig. 5: Local Control panel

3.1 EXPLANATION FUNCTIONAL PARTS

The W-GV4 genverter is a very advanced high tech variable speed power supply system. It combines new technologies from different fields such as engine technology, PM alternator technology and inverter technology.

3.1.1 Control system

The engine is monitored and controlled by microprocessors in the Digital Diesel Control system that cooperates with the inverter unit. The standard electrical engine control system is 12 Volt negative earth, non earth return (ungrounded) is available as option. Check your identification data to determine which system is applied. The system is designed according to the "energise to run" system. This means it stops when the 12 V DC voltage is taken away. The Digital Control is a very advanced system. It controls the engine and also operates as a management system to control the engine in combination with the inverter. There is a link between the inverter and the actuator (speed control by a step motor) on the engine. When the genverter is operating in the “variable speed mode” the inverter will signal the engine to speed up when the load increases, to slow down when load decreases. Settings of minimum and maximum speed could be necessary to optimize the operation. It is also possible to set a speed for fixed speed running. This could be more comfortable when a constant load is applied or for service.

3.1.2 Remote control panel

1 Start button;
2 Stop button;
3 Select button;
4 Set button;
5 Failure lamp;
6 Generator load indicator.
7 Display

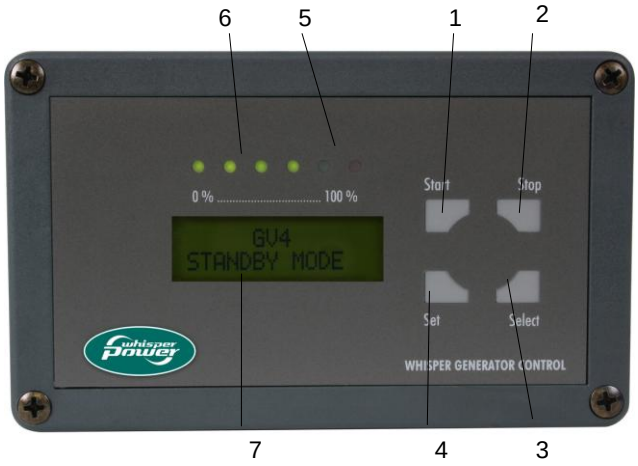


Fig. 6: Digital Diesel remote control panel

3.1.3 AC Permanent Magnet Alternator

The Three Phase Permanent Magnet Alternator is incorporated in the flywheel and has a very high efficiency of 94% or higher because of the very high tech super magnets that are used. The output of the power from the alternator will be between 250V-300Hz and 400V-500Hz, depending on the engine speed. As the efficiency is very high, little cooling is needed. On the alternator is a fan that circulates air to cool the windings. Further technical data on the design of the alternator can be found in drawings and diagrams in this manual.

3.1.4 Inverter

A state of the art inverter is applied to invert the high voltage output from the alternator to 230V 50Hz AC. The inverter is completely “potted” in polyurethane to protect the components for humidity and dirt. The inverter is situated in a separate compartment of the sound shield enclosure, or could be mounted in an other space (not standard).

3.1.5 Engine

The engine used in the genverter is developed by Whisper Power and manufactured exclusively for Whisper Power. The concept is unique as the engine is fully cooled by oil. The same oil that is used for lubrication is also used for cooling. However the lubrication circuit is separate from the cooling circuit that has its own pump.

As the cylinder and cylinder head are surrounded by oil the noise of the engine itself is extremely low. The oil cooling makes it possible to apply the engine in an almost fully enclosed canopy, what makes the genverter even more silent. The oil is cooled by a relatively small radiator.

The radiator is standard integrated in the sound shield canopy, but van be placed separately.(not standard)

One could use the hot oil for generating heat (CHP Combined Heat Power generation). For this application information additional from Whisper Power is required

The engine is directly injected and designed to meet the highest exhaust emission standards.

Further details are in the data sheet on page 16.

3.1.6 Battery charger

In the system is a battery charger generating 10 Amp 12V DC to charge the starter battery. The voltage is regulated at ±14.4V.

3.1.7 Alarms and shut down

In the event of malfunctioning this will be indicated by the failure light, details will be shown on the display and the engine will shut down. There are three functions guarded: lubrication oil pressure, cooling oil pressure and oil temperature.

The oil temperature is monitored by a sensor, the oil pressure by switches. The DDC will generate an alarm when the oil temperature is too high or the lubrication oil pressure is too low, or the cooling oil pressure is too high.

The oil pressure alarm switches are closed when the engine is running and no malfunction occurs. The oil temperature sensor will give an analogue signal to the processor The processor will shut down the engine when the oil temperature is higher than 120° C. In case of a failure one of the contacts will open and the engine will stop. This means that the Genverter will not work when the alarm switch is faulty or there is a loose wire. This means the system is intrinsically safe. It also means that the oil pressure switch is open when the engine is not running and the alarm blocked for 10 seconds when starting.

The panel will display details about the alarm.

3.1.8 Control

The Genverter can be operated by push buttons on the panel on the unit or on the remote control. By pushing the START button the control system is activated and will start the engine automatically. Pushing the STOP button will stop the engine and the electrical system will be deactivated. When using the Genverter in an automatic mode the engine will start when power is demanded, because of low batteries or an other “event” that triggers the starting operation. To use an automatic mode the system has to be set up for this mode. This can be done via the remote control panel. The speed of the engine is variable and will adapt to the load. Settings of minimum and maximum speed could be necessary to optimalize the operation. It is also possible to set a speed for fixed speed running.

Refer to the DDC Operation manual.

3.1.9 Remote control panel

By the remote control panel one can make the different settings and it displays various parameters such as Voltage, Hz, Amps, and many others (refer to the DDC manual for details)

The connection from the remote control to the genverter control unit is made by plug in connectors.

An intermediate communication cable is in the standard supply. If necessary an optional longer or shorter 8 wire communication cable can be connected if the standard length does not suit the required distance. Numerous remote control units can be put in parallel by using the connectors on the back of the units. (Refer to installation instructions)

3.1.10 Hour counter

The remote control offers several timer functions that helps to schedule maintenance.

3.1.11 Load indicator

On the local panel and on the remote control the load will be indicated on the display and/or by the LED-bar.

3.1.12 Fuel

1 Specification

The engine must only be used with diesel fuel oil which conforms to the standards for use in modern diesel engines. Fuel free from water and contaminants is of the utmost importance. The following specifications must be complied:

Diesel Fuel Specification	Location
EN590:96	European Union
BS 2869-A1 0r A2	UK
No. 2-R, No 1-D, ASTM D975-94	USA
GB252	China
ISO 8217 DMX	International
JIS K2204 Grade No.2	Japan
KSM-2610	Korea

Fig. 7 Fuel specifications

2 Diesel pre-heater

As an option a diesel pre-heater can be mounted. This is a special feature for applications in extreme cold conditions. In this case the fuel filter will be inside the canopy and before the filter will be a heating element that will prevent the formation of paraffin crystals in the diesel and clogged filters as a result. The operation is temperature-related. The system is controlled by an independent switch to turn it “on” or “off”.

3.1.13 Bio-diesel

The use of diesel fuels to a maximum blend of 5% (by volume) of Fatty Acid Methyl Esters (FAME) known on the market as 5B diesels is allowed as far as these B5 diesel fuels meet the following requirements:

Europe; compliance with EN 14214

USA; compliance with ASTM D-6751

Bio-fuels should be supplied by recognised and authorized suppliers only: ”Self blended fuels” could cause engine damage and will affect warranty.

Be aware that free methanol in FAME may result in corrosion of aluminium parts. Free water in FAME may result in choked fuel filters and injection nozzle and may result in increased bacterial growth.

3.1.14 W-GV4 oil cooler

The W-GV4 engine is cooled by oil and not by cooling liquid. The oil cooling radiator of the W-GV4 is not ventilated. The system is ventilated by the engine itself and no expansion tank is applied. When it is not possible to drain the oil from the radiator every time the oil is changed, one should pump out the engine oil as good as possible from the engine sump and increase the oil change intervals to every 100 running hours, depending on the way of using the genverter. A dedicated interval recommendation can be given for special applications by Whisper Power.

3.1.15 Oil information

1 Specification:

The oil must be suitable for oil changes as specified in the maintenance chapter. The engine must be run on heavy duty lubricating oil meeting the requirements of API class CD, CF or CF_4. A well known brand is recommended.

It is very important to use the correct oil specification. Very often local oil suppliers recommend a higher API class, because they assume that a higher class is allowed. This is not the case. One should not follow these recommendations as these higher class oils contains additives that could cause high oil consumption.

Never mix different types of oil.

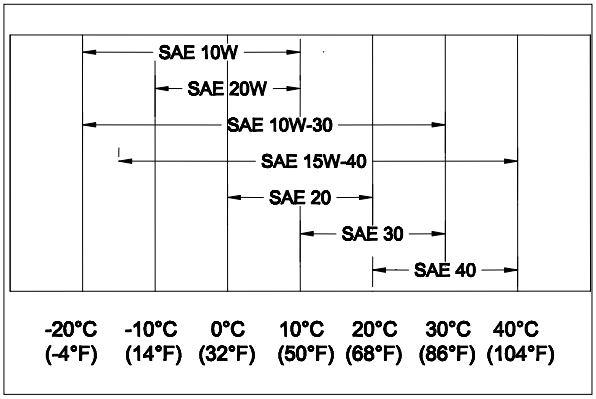


Fig. 8 Viscosity Chart

2 Oil viscosity:

We recommend a multi grade oil 15W40.

Cold or hot conditions a special grade could be applied according to the Viscosity Chart below:

It is very important to select the right viscosity. Specially in cold conditions the viscosity of the oil should be low (so the oil should be “thinner”) to keep the oil pressure in the cooling system within acceptable limits.

3 Oil capacity:

The content of the crankcase is as specified below:

Excluding radiator and piping:	2 Liter
Including radiator and 2 m piping:	2.9 Liter

Do not overfill with lubricating oil as this may have a detrimental effect on engine performance. Refer to the maintenance chapter for details.

4 Lubrication oil pressure

- Minimum at idle 49 Kpa (0,5 kgf/cm^2 - 7psi).
- Normal at 3000 rpm between 147 and 490 Kpa (1,5 up to 5 kgf/cm2 - 21 up to 71 psi).
- Minimum at 3000 rpm 98 Kpa (1,0 kgf/cm 2 - 14 psi).

5 Cooling oil pressure pressure

- Minimum at idle 149 Kpa (1.5 kgf/cm^2-21 psi)
- Normal at 3000 rpm (80°C between 180 and 220 Kpa (1,8 up to 2.2 kgf/cm2 – 25 up to 35 psi).
- Maximum cooling oil pressure is protected by an overpressure switch that will trip at 550 Kpa (5.5 kgf/cm2 – 80 psi). In cold condition the pressure can be higher, but the alarm will be suppressed.

6 Cooling oil temperature

- Max oil cooling temperature 120°C (oil out to the cooler).
- Min oil temperature 70°C.
- Sump oil temperature should be between 80°C and 90°C for optimal performance

3.2 TECHNICAL DATA

3.2.1 General

Model	W-GV4
RPM	2500 up to 3400
Intermittent Power	3.8 kW 230V 50Hz at 3400 rpm
Continuous Power	3 kW 230V 50Hz at 3000 rpm
Peak output 5 seconds	36A I^2t

ENGINE	
Model	Whisper Power; direct injected, oil cooled diesel engine. WP 1
Number of cylinders	1
Displacement	306 cc
Bore X stroke	78x64 mm
Combustion air consumption	0.42 m^3/min.
Intermittent power engine	4.4 kW at 3400 rpm (SAE J1349, ISO 3046/1) (Ambient temperature 25°C; Atmospheric Pressure 100kPa, Rel. humidity 30%)
Continuous power engine	3.5 kW at 3000 rpm
Fuel temperature	Max. 40°C at fuel injection pump
Fuel consumption	0.8-1.5 litre/hour, load dependent
Fuel lift pump engine	Electric pump (12 V DC); additional pump available upon request
Cooling system	Oil cooled by means of dedicated trochoid pump on the engine and radiator.
Lubrication system	Forced lubrication with dedicated trochoid pump (different from cooling pump)
Starting battery (optional)	55-90 Ah 12V
Starting system	Starter motor
Control	Digital Diesel Control including automatic start/stop

3.2.2 Alternator

Type	Permanent Magnet integrated in flywheel
Output voltage	310 V-400Hz 3 phase line to line 3 phase at 3000 rpm
Output rating	5 kW (oversized)
Efficiency	94%

3.2.3 Inverter

Input Voltage	400V-500Hz, 3 phase (max)
Output voltage	230V 50 Hz alternating current (AC) single phase
Output rating	4 KVA
Voltage tolerance	± 5 %
Frequency tolerance	± 0.1%

3.2.4 Mechanical specifications

Supply includes	Sound shield with steel base, mounted on double set of rubber anti vibration mountings. (Genverter without sound shield is optional)
Dimensions l x w x h	630x480x520 mm
Colour	Metallic silver / white
Weight	92 kg including sound shield
Standard supplies	Digital remote panel (10 m cable), fuel filter, fuel lift pump, user and installation manuals
Available as option:	Installation kits, non earth return (ungrounded), spare part kits, longer or shorter DDC cables.

3.2.1 Electrical diagrams

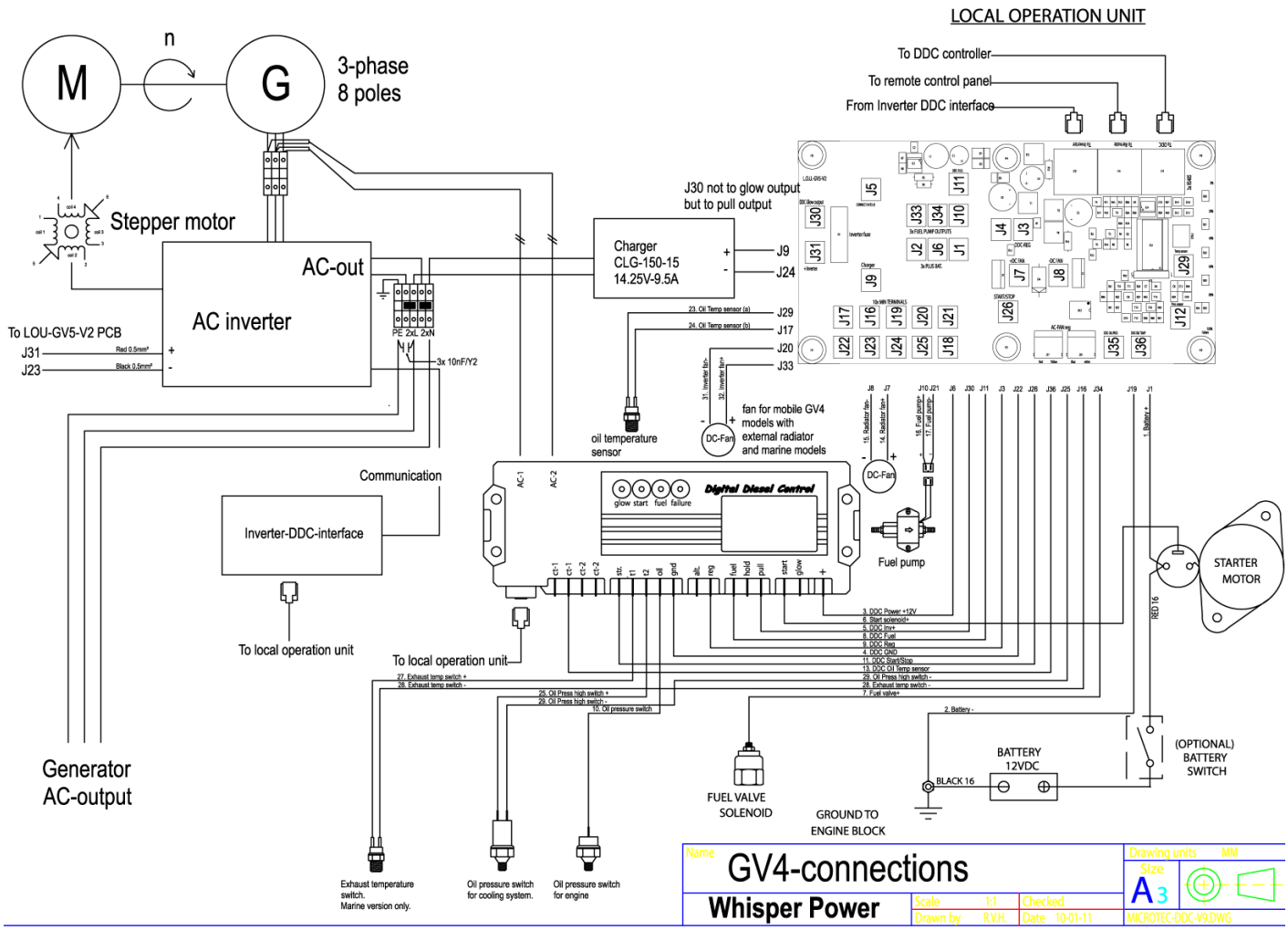


Fig.9: Electrical diagram overview

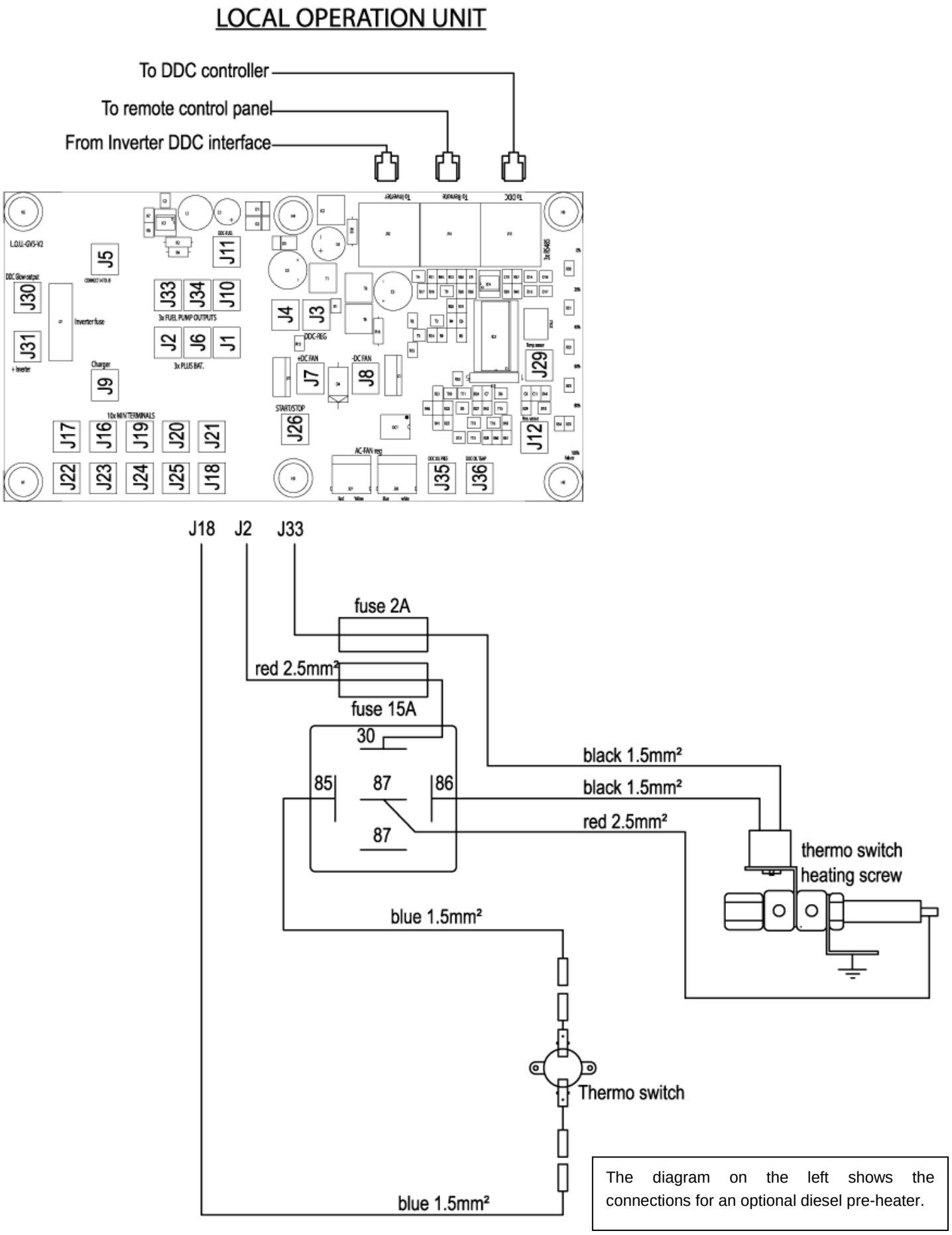


Fig.10: Electrical diagram control panel and optional diesel pre-heater

3.2.6 Lay out connections

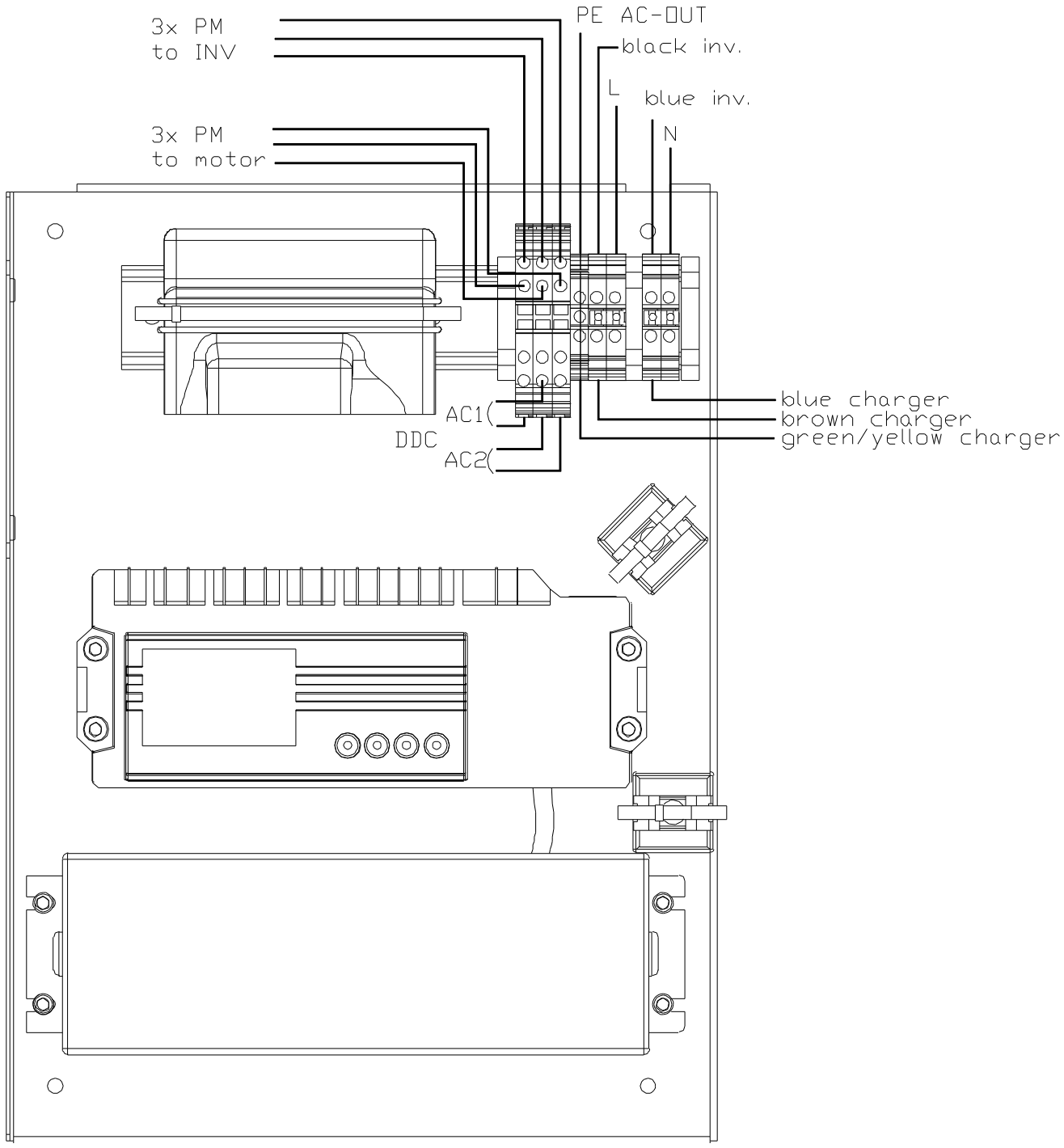


Fig. 11: Lay out connection terminals

4 OPERATION

4.1 GENERAL

The genverter is operational after full installation and filling up with: fuel, engine lubricating oil, connecting the battery and connecting the digital remote control panel. Fill oil twice to allow the radiator to fill. Fill up with oil, run for 60 seconds, stop the engine and fill up again.. **When checking the oil level simply dip the dipstick into the oil without screwing the dipstick into the sump.**

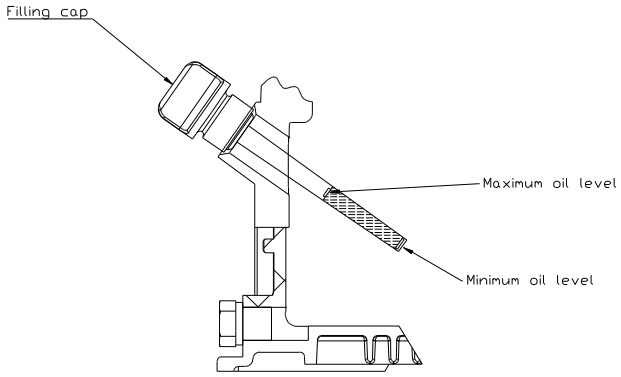


Fig. 12 Dipstick

4.2 OPERATION MODES TO BE SET

There are different modes to be set for operation. Settings can be made on the remote control panel.
Refer to the separate DDC operational manual for detailed instructions.

1 **VARIABEL SPEED** operation. In this mode the engine will start when pushing the starting button. The speed will adapt to the load. When an additional load will be switched on the engine will speed up. To avoid that the engine will not be strong enough to speed up while a new heavy load is added, **the minimal engine speed has to be set to a level from which the engine can speed up** in the most unfavourable situation that can be occur.
Example: When the engine is running at no load (or almost no load at 2500 rpm) and a 3 kW load (e.g. an airco) with an inrush current for motor starting of 4 x nominal power is switched on the engine will probably not be able to ramp up the rpm. In this case the low speed setting has to be higher; possibly 2800 rpm. However when load steps of only 1 kW are switched on, one after an other, a low speed setting at 2500 rpm will be OK. The optimal low rpm setting can be found by trial and error.

2 **FIXED SPEED** operation
When variable speed operation is not a favourable option, it is possible to run the genverter on a fixed speed. This could be the case when a constant load is applied.
One can select the fixed speed mode on the remote control panel and set the desired speed related to the required output power.

4.3 OPERATING INSTRUCTIONS

4.3.1 Summarised operating instructions (daily use)

Routine "pre-start" checks:

1 Check oil level (refer to fig. 12).
2 Power source selector switch (off/external power/Genverter power). Switch to power source switch "OFF", or switch off all consumers in the usual way.
3 Switch on battery switch (when installed).
4 Fuel valve: open.

Starting:

Push the start button and hold for a second to initiate the full automatic starting procedure.

In operation checks:

1 Check for abnormal noise or vibration
2 Check the output parameters on the remote control display.
3 Power source selector switch (off/external power/Genverter power). Switch to power source Genverter. Before loading the Genverter up to maximum, have it run warm. Continuous load should be restricted to 70 % of maximum load.

Stopping Genverter:

1 Switch off all electrical devices (consumers). If the genverter has been running under full load for a longer period, do not shut it down abruptly. Reduce the electrical load to about 30% of the rated load and let it run for approx. 5 minutes.
2 Press the STOP button.
3 Switch to an other AC power source, if available

4.3.2 Extended operating instructions

Check when starting the first time or after a longer period of rest:

1 If there is any damage caused by transport or installation.
2 Check if the installation conforms to the installation instructions.
3 Ensure the engine is free to turn without obstruction.

4 (Refer to valve clearance instructions in the maintenance chapter how to turn the engine)
5 Check all hoses and hose connections for leaks.
6 Check all cables and terminal connections.

Routine "pre-start" checks:

1 Check engine oil level.
The Genverter switches off in the event of insufficient oil-pressure. Even when the oil level is too low the oil pressure can be high enough not to trip an alarm. Do not run the engine with the oil below the lowest mark, because a smaller volume of oil will become contaminated considerably quicker than a larger volume. Also the cooling can be affected. Therefore we recommend daily oil-checks.
Check oil level prior to starting the engine or at least 5 minutes after the engine has stopped.
2 Check for leakages.
3 Switch main Power Source Selector switch to "OFF" or switch off all devices.
4 Switch on the battery switch (when installed).

Starting the Genverter:

By pushing the start button and hold for a second the electric system is activated. You can monitor the procedure on the display of the remote control panel. First the fuel pump will prime the fuel for a few seconds (settable), the starter will crank the engine un till it starts. While starting the alarms are blocked. The alarms will be activated after 10 seconds.
(by pushing the Stop button the system is deactivated).
The first time starting up or after running out of fuel it could be necessary to **prime the fuel system**. Push the start button activating the electric system and activating the fuel pump. When more time is needed to bleed, push “start” and “hold” the button on the local control panel (so not on the remote panel). When holding the button the pump will work, but the unit will not start. Hold as long as necessary to bleed the system. (Refer to bleeding fuel system instructions in the maintenance chapter 5.2.2.).

Cold start: Using the generator in open air in winter time with temperatures far below zero could cause starting problems. Remove the small orange oil screw plug on the cylinder head cover and add 2 cc of engine lubrication oil before starting. Push down the decompression lever. It will return automatically when cranking.

Never use ether or gasoline for cold start as it could damage the engine.
Warm up the engine without load for 3 minutes.

A restart protection prevents starting the engine when it is already running, which could cause damage.

Checks once the engine is in operation:

1 Check for abnormal noise or vibration.
2 Check the output parameters on the remote control display.
3 Power source selector switch (off/external power/genverter power). Switch to power source Genverter. Before loading the genverter up to maximum, have it run warm.
4 Observe the exhaust at the normal full load.
The exhaust must be free from soot. Do not allow the engine to run with a dirty exhaust without investigating the cause as this may result in an expensive breakdown. When ramping up RPM the engine will probably produce some smoke. After stabilizing on the right RPM for the load the exhaust should be free from soot.

Engine load during longer operation:
The first 50 hours of running the continuous load should be restricted to 70 % of maximum load. Running for long periods at no load or light load in the first 50 hours can cause cylinder glazing and high oil consumption.

Ensure that the Genverter is not overloaded. Overloading occurs when the electrical load (demand) is so high that the alternator cannot be turned around properly by the diesel engine. Overloading causes the engine to run rough, while using oil and excessive fuel and producing soot by the exhaust. The engine can even stop.

The Genverter should therefore only be loaded at the maximum rated power for short periods (2-3 hours) only!
The high peak current is meant for the ability to start electrical devices that need a high current for starting especially electric motors and compressors (from a still stand state).

In order to prolong the genverter life expectancy, the nominal electrical demand on the system should be about 70% or the rated Genverter’s maximum load. Please note this when switching on your electrical devices!
Nevertheless, the Whisper GV4 is designed so as not to overheat, even under extreme conditions.

Do not run the genverter for very long periods at no load or at very low load. When this is necessary do

load the Genverter at least one hour in 10 hours for minimum 70%. Long term running at too low load will cause the exhaust to be choked by carbon (soot).

Never remove the battery while the engine is running or any electrical cable while the battery is connected in the circuit. Only disconnect the battery with the engine stopped and all switches in "OFF" position

Stopping the Genverter:

1 Avoid stopping of the Genverter abruptly after a long period of operation at high load! Doing so, you avoid unnecessary thermal load to the engine!

2 Do not stop the engine with the decompression lever unless in emergency when there is total loss of control.

Act as follows:
Prior to switching off the Genverter, decrease the Genverter load (i.e. turn off most electrical users) and let the genverter run at low load for approx. 5 minutes to allow the engine to get properly cool (the influent coolant oil must flow through the system in order to cool the engine).
If the genverter is operating in a hot environment and you do not act as given above, the excessive heat in the engine can trip the "high temperature" alarms. In that case, a restart of the engine is not possible for some time. It is also recommended to switch off electrical users prior to stopping the Genverter because of the voltage drop that occurs as the engine comes to a halt.

3 Press the STOP button.

4 Switch to an other 230V power source, if available.

If the engine is not running and ‘failure’ and ‘charging’ LED is blinking, reset by stop button, otherwise it will drain the start battery

5 MAINTENANCE

5.1 ALTERNATOR

The alternator does not require any maintenance.

5.2 ENGINE

5.2.1 Preliminary instructions

All regular maintenance can be carried out when the enclosure is open. When oil and dirt has gathered in the enclosure measures have to be taken to avoid spilling oil and polluting the environment.
The first service on the engine should be carried out after 50 hours of its life and after a major overhaul. In the first 50 hours the engine should receive special attention:

Long periods of light or no load running in the first 50 hours may lead to cylinder glazing and high oil consumption.

For the same reason it is of the greatest importance to use the right oil specification

The first time starting up or after running out of fuel it could be necessary to prime the fuel system.

5.2.2 Bleeding fuel lines

Ensure there is sufficient fuel. The system is self bleeding. The first time starting up or after running out of fuel it could be necessary to prime the fuel system. Push the start button activating the electric system and activating the fuel pump. When more time is needed to bleed, push “start” and “hold” the button on the local control panel (so not on the remote panel) When holding the button the pump will work, but the unit will not start. Hold as long as necessary to bleed the system.

5.2.3 Valve clearance

When the engine is in cold condition both valves (inlet and outlet) should have a clearance of 0.15 mm $\pm$ 0.03. The adjustment has to be done at TDC (refer to § 5.4.3).

5.2.4 Replacing fuel filter

Filter change depends on contamination of the fuel, but should be done at least every 400 running hours. Before changing the filter, clamp off the supply line. Remove the hoses from filter and attach them on the new filter again. The arrow on the filter housing indicates the direction of the flow. A clogged filter results in a lack of output of the engine and irregular running.

5.2.5 Cleaning oil strainer

The oil strainer is in front of the service side. Cleaning has to be executed according to the schedule in this manual. Drain the oil using a vacuum pump; put some tissues under the cap.

5.2.6 Air filter element

The W-GV4 is standard supplied with an air inlet filter element Filter change depends on environmental contamination. Check the air filter at least every 400 running hours. The foam around the filter element can be cleaned by compressed air. Do not use solvents to clean the foam The filter cannot be cleaned and must be replaced. Access to the filter can be obtained by unscrewing the wing nut and pulling the engine towards the service side. The filter can now be replaced.

5.3 REGULAR MAINTENANCE

CHECK DAILY:

- Oil level (see fig. 13)
  Before checking the oil level wait at least for five minutes after stopping to give the oil the time to get down in the sump.
  When checking the oil simply dip the dipstick into the oil without screwing the dipstick into the sump.

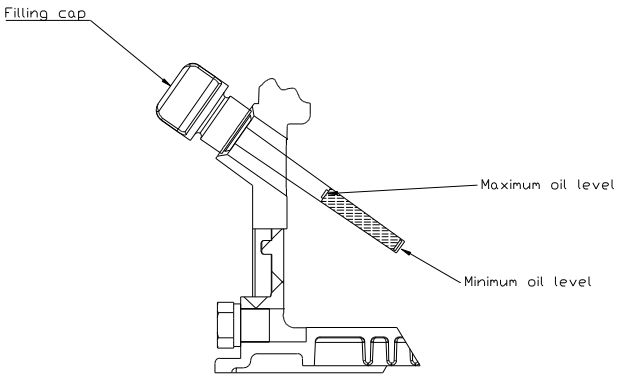


Fig. 13 oil dipstick

AFTER FIRST 50 HOURS:

- Change oil and clean the oil filter.

In practice it will not be possible to change all oil in the system, because some oil will be left in the cooling system. Therefore we advice to change the oil twice:
Have the engine run until it is on temperature and stop it. Drain oil by using a vacuum pump as commonly used in garages to drain the oil. Refill the engine with oil; start the engine and have it run for 5 minutes. Stop the engine and

pause for a few minutes to let the oil gather in the crankcase. Drain the oil again and refill with fresh oil for the second time. Start again; after 5 minutes stop; pause for a few minutes check the level and add oil when necessary.

- Check and tighten nuts, bolts, and unions, paying particular attention to the fuel system. (refer to chapter 6.3.1)
- Observe the exhaust at the normal full load.
  The exhaust must be free from soot. Do not allow the engine to run with a dirty exhaust without investigating the cause as this may result in an expensive breakdown. When ramping up RPM the engine will probably produce some smoke. After stabilizing on the right RPM for the load the exhaust should be free from soot.
- Check the electrical connections.

EVERY 200 HOURS:
- Change oil. When the running hours are low over a long time period; increase to 150 or 100 hours.
- Clean the oil strainer
- Check the battery acid level (not applicable when sealed batteries are used).
- Check battery terminals for corrosion

EVERY 400 HOURS:
- Check and replace when necessary the air filter (do not clean the air filter element); clean the foam around the element with compressed air and clean the strainer element
- Replace the fuel filter
  Replacement depends or the condition of the fuel. We recommend replacement every 400 hours. Isolate the fuel supply and change the element.
- Check and clean the radiator (use compressed air)
- Adjust the valve clearance. (Refer to § 6.3.4).

EVERY 1000 HOURS:
- Retighten the cylinder head bolts and adjust the valve clearance. (Refer to § 6.3.2 and § 6.3.4).
- Check lubricating oil pressure
- Check hoses and wires
- Clean and check or replace fuel injector nozzles and check injection pressure.

EVERY 2000 HOURS:
- Check the valve seats

When the Genverter runs less than 200 hours a year the oil should be changed yearly

5.3.1 Maintenance schedule

Check oil level	daily
Change oil and clean oil strainer	after first 50 hours
Check and tighten nuts, bolts, etc. (refer to chapter 5.4.2)	after first 50 hours
Check electrical connections	after first 50 hours
Change oil	200 hours
Check battery	200 hours
Clean oil strainer	200 hours
Replace fuel filter	400 hours
Check the air strainer and filter element	400 hours
Check and clean radiator	400 hours
Readjust valve clearance	400 hours
Retighten cylinder head bolts and readjust valve clearance	1000 hours
Check al hoses and wires	1000 hours
Check lubricating oil pressure	1000 hours
Check injection nozzle and injection pressure	1000 hours
Check for compression	1000 hours
Check the valve seats	2000 hours

5.3.2 Putting out of service

When not using the genverter for a longer period it is recommended to execute an engine preservation procedure.

1 Clean the engine.
2 Loosen the fuel suction pipe and fuel return and put them in a can with preservation diesel fuel. Start the engine and run the engine warm.
3 Stop the engine.
4 Drain the hot engine oil and refill with preservation oil.
5 Open the orange oil screw plug on the cylinder cover and add 2 cc preservation oil.
6 Disconnect the battery and store it in a dry place free of frost and charge it regularly.
7 Close inlet- and outlet openings with tape.
8 Protect the Genverter against the influences of bad weather conditions.

This method of preservation will be sufficient for 6 months. Change oil before using the engine again.

6 TROUBLE SHOOTING

6.1 GENERAL

If any problem should occur, check basic conditions and examine all external wiring, switch gear and circuit breakers. Also check if measuring instruments give the correct value. If in doubt, measure directly on the alternator terminals with an independent instrument.

If during these measurements the engine immediately stops after starting and an error code is displayed at the remote control panel (“AC VOLTAGE”), one can start the Genverter by means of a “service start” at the service menu (see paragraph “service start” of the user’s manual of the Digital Diesel Control). By doing this, the Genverter will keep running for 2 minutes before it stops. This offers you the possibility to carry out measurements to investigate the cause of the failure. This procedure should only be carried out by an experienced electrician.

6.1.1 Failure codes

A failure code is displayed when a failure at the genverter is detected. A warning code is displayed when a parameter deviates from the setting.

Warning code	Problem
NO WARNING	None (no warning was detected)
LOW/HIGH RPM	The engine runs faster or slower than it was set to do.
LOW STARTBAT	Voltage of the start battery (BAT1) is below setting
NO BAT2	No second battery detected or voltage is below 5V while nominal voltage is set at 12V or 24V check connections/ fuses/ polarity of the second battery)
LOW BAT2	Voltage of the second battery (BAT2) is below setting
AC- VOLTAGE	Genverter AC output voltage is too low.
HIGH CURRENT	Output current of the Genverter is above
COMMUNICATION	Communication error between the panel and the Genverter. Check the cable connection between the panel and the control unit.
OIL PRESS HIGH	The pressure switch in the cooling system indicates a too high oil pressure
OIL PRESSURE	The oil pressure in the lubrication system is too low
ENGINE TEMP	Temperature engine oil temperature is too high

Failure code	Problem
NO FAILURE	None (no failure was detected)
COMMUNICATION	Communication error between the panel and the Genverter
LOW BAT1	Starter battery voltage (BAT1) too low
PM ALTERNATOR	Voltage PM alternator is not OK .
EXHAUST TEMP	Exhaust temperature is too high (marine Genverters only)
OIL TEMP	Oil temperature too high
OIL PRESSURE	Oil pressure failure (lubrication oil pressure too low)
OIL PRESSURE HIGH	To high cooling oil pressure
AC VOLTAGE	Inverter AC output voltage is out of range
OVERLOAD	Inverter overloaded
SHORT CIRCUIT	Inverter output short circuit
INV. OVERHEATED	Inverter temperature too high
SOFTWARE INV	Software failure in inverter
COMM ERROR INV	Communication between inverter and interface lost
FAILURE TO START	No start signal

6.2 ALTERNATOR/ ELECTRICAL FAULTS

Beware of parts which are live! The alternator generates high voltage up to 650 Volt

Remove 3 Amp. Fuse in the control panel while working on the Genverter to prevent the engine from starting

6.2.1 Trouble shooting table inverter /alternator

PROBLEM	CAUSE	SOLUTION
No output (Voltage) at all	• Circuit breaker "off" or faulty fuse	Check switches and fuses and measure directly on the alternator to exclude external causes.
	• Low engine RPM.	Check the engine RPM and adjust (refer to special procedures).
	• Inverter failure	Contact Whisper Power Service
	•	
	•	
Genverter output voltage too low when no load is on it (less than 210V and RPM is above 2500 RPM	• Alternator failure	Contact Whisper Power Service
	• Inverter failure	Contact Whisper Power Service
	•	
	•	
Genverter output voltage too low under load (less than 210V/105V). In no load condition it is ok	• Genverter is overloaded.	Switch off a load; (part off) consumers.
	• Engine is not reaching the RPM needed to bring the demanded load.	Refer to settings minimal RPM.
	• Engine RPM drops when loaded	Refer to engine section: RPM drops when loaded
Genverter voltage fluctuates	• Disturbances on the electrical system/ user side.	Check if electrical load is fluctuating
	• Engine runs irregularly.	When engine runs irregularly refer to engine section: "Engine runs irregularly".
Genverter voltage too high, (more than 245V/130V)	• Check with independent measurement instrument	
	• Inverter failure	Contact Whisper Power Service
Genverter is not able to start an electric motor	If the Genverter is unable to supply enough power to start an AC electric motor, this is usually because this motor draws too much current during starting.	Check the electric motor's current draw required for starting. This should not exceed the rated Genverter peak output current. This could be remedied by setting the low rpm level higher or using a "soft-start". Inquire at your nearest Whisper Power dealer or directly at the manufacturer, Whisper Power in the Netherlands.

6.2 ENGINE FAULTS

Remove 3 Amp. fuse in the control panel while working on the Genverter to prevent the engine from starting.

6.2.1 General

When the engine is not cranking well, starting problems almost always originate from battery problems or poor battery cable connections.

When the engine is cranking, well starting problems almost always originate from lack of fuel or air bubbles in the fuel pipes.

A failure code is displayed when a hardware failure at the engine is detected.

6.2.2 Trouble shooting table engine

PROBLEM	CAUSE	SOLUTION
Diesel engine fails to crank; no response at all	•Faulty fuse on the control panel	Replace fuse
	•Battery switch off	Switch on

PROBLEM	CAUSE	SOLUTION
	•Batter completely empty	Charge or replace battery
Diesel engine fails to crank, the starter makes clicking noises, or the engine cranks very slowly.	• Almost certainly this is a battery problem. Display will indicate "LOW START BAT"	The problem must be in the battery or in the connections to the starter motor.
	• Starter battery voltage insufficient (battery too weak).	Check battery voltage. Recharge the battery. Inspect battery terminals and cables for a good electrical connection (inspect against corrosion, tattered wires, etc.)
	• Wiring system faulty	During the normal starting process, the battery voltage drops to 11V (with a fully charged battery). If the voltage does not drop during starting, the electrical connection is faulty. If the battery voltage drops lower than 11V, then the battery has been discharged too deep.
	• Starter broken	Repair the starter motor
	• To thick engine lubricating oil.	Change oil for a lower viscosity.
Starter is turning engine smoothly, but engine fails to start	• Out of fuel or faulty fuel, water in the fuel.	Fill up with fuel or replace with better quality.
	• Fuel solenoid is not opening (no "click" can be heard).	Check wire connections and circuitry to solenoid. (Refer to DC wiring diagram)
	• Fuel lift pump is not working.	Check fuel filter and fuel lift pump: clean or replace if necessary.
	• Air in fuel lines.	Bleed air from fuel system (refer to maintenance section).
	• Blocked injector.	Have the injector tested and cleaned if necessary.
	• Wrong valve clearance.	Adjust valve clearance,
	• Low compression because of dirty valves.	Clean valves. Take off the injection bent and inspect the outlet port. When soot in the port clean the valve by taking off the valve spring and rotate until rust is removed. When the outlet port is strongly affected by soot, the engine is not properly used or there is an other malfunction. Contact Whisper Power service department for advice.
	• Loss of compression by wear out or damage	Repair by Whisper Power service
Engine runs irregularly.	• Unsuitable contaminated fuel • Lack of fuel •	Fill up with fuel or replace by better quality .
	• Air in the fuel pipes	Bleed air from fuel system (refer to maintenance section).
	• Choked fuel filter.	Check fuel filter replace if necessary.
	• Disturbances on the electrical system/ user side.	Check if electrical load is fluctuating
	• Faulty fuel lift pump.	Check and repair or replace
	• Choked air filter. • Lack of air.	Check the air intake
	• Choked exhaust system, exhaust blocked,.	Check the exhaust piping; inspect manifold inside
	• Faulty actuator	Replace faulty parts. Contact Whisper Power service department for advice
	• Blocked injector.	Have the injector tested and cleaned if necessary.
	• Wrong valve clearance.	Adjust valve clearance.
	• Lack of fuel.	Check fuel supply system: fuel pump and filter.
Engine speed drops	• Genverter overloaded	Reduce the electrical load (switch off some consumers).
	• Fuel problem	Check fuel supply and clean fuel filter
	• Too much oil.	Drain oil to proper level
	• Lack of intake air.	Check air intake. (clean air filter)

PROBLEM	CAUSE	SOLUTION
	• Choked exhaust system, exhaust blocked.	Check the exhaust piping; inspect manifold inside
	• Faulty actuator	Contact Whisper Power service department for advice
	• Defective alternator (windings or other)	Genverter must be sent to manufacturer for repair of damaged bearing or winding.
	• Damaged engine	Repair by Whisper Power service
Engine does not stop on command	• Fuel solenoid is not switching off • Loss of control	Faulty Digital Diesel Control unit. Stop the engine manually by the stop handle. Check wire connections to stop solenoid. Check solenoid valve function. Replace if necessary
Engine exhaust smokes	• Faint blue smoke - generally the result of light load	Increase load.
	• Heavy blue smoke - caused by lubricating oil: Overfull oil sump or worn cylinder bore, stuck broken or worn rings.	Check the oil level. Check the compression.
	• When the engine RPM is ramping up to react at a load step some smoke could be unavoidable. • Wrong setting of minimum RPM. • Sooty black smoke –incomplete combustion caused by: Overload, choked air filter, air inlet temperature too high, unsuitable fuel or water in fuel. • Valve clearance incorrect. • Continuous running with very low load.	Readjust minimum rpm setting Check the fuel . Check for overload. Check the air filter Adjust minimal RPM setting Readjust valve clearance Increase load and have the engine run for a few hours
Engine starts, but stops after 10 up to 30 seconds	• Protection system stops the engine; this can be caused by oil pressure failure, loose wire or faulty alarm switch. Digital Diesel Control will help to indicate failure. • Faulty alarm switch/sensor	Refer to Chapter 3 and page 24 and the DDC operations manual for information on the alarm system. Bypassing a switch can help to confirm the failure. But be aware: Running with a by-passed alarm switch can cause damage! Replace the switch. By-passing the switch makes it possible to keep running. But be aware: Running with a by-passed alarm switch can cause damage!
Engine stops by itself	• Overload or short circuit.	Switch off the consumers and test for short circuit.
	• Lack of fuel.	Check fuel supply system: fuel lines, pump, filter, valves, tank level, etc.
	• Oil pressure low. (oil pressure switch tripped).	Check oil level. Check engine's oil pressure and have it repaired by Whisper Power.
	• Air or water in the fuel. • Blocked air or fuel filter.	Check and clean
	• Loss of compression by wear out or damage.	Repair by Whisper Power service.
Loss of power	• Wrong measurement. Check if the load is measured correctly. Does the Amp meter show the correct value? When calculating the load by multiplying voltage and amps this should be done by using the exact values, taking into account the power factor of the consumers. When any doubt, measure the power directly with an appropriate instrument.	
	• Overfull oil sump.	Bring the oil to the correct level
	• Choked fuel filter.	Replace the fuel filter.

PROBLEM	CAUSE	SOLUTION
	• Choked air filter.	Check air inlet openings; clean air filter.
	• Exhaust blocked.	Check the exhaust system.
	• Injector blocked.	Have the injector checked.
	• Loss of compression, sticking or damaged piston ring.	Have the compression measured. Clean or replace the rings.
	• Wear out of cylinder.	Have the compression measured and have the engine overhauled.
Over-temperature	• Overload.	Take away the overload.
	• Radiator choked by dirt • Hot air circulation in the radiator.	Clean radiator
	• Exhaust choked with carbon • Cooling circuit failure	Clean exhaust Contact Whisper Power service

6.2.3 Warnings

Genverter must be shut off immediately if:

- Unusual noise comes from Genverter.
- Exhaust gases suddenly colour dark.
- Engine failure warning light is on

6.2.4 Service address

If you cannot correct a problem with the aid of the malfunction table, contact your Whisper Power Service Centre or Whisper Power Netherlands for an extended service list,
tel: INT +31-512-571555. 7x24 Hr service.

6.3 SPECIAL PROCEDURES ENGINE

6.3.1 Standard torque chart

Size	M6x1.0	M8x1.25	M10x1.5
N-m	10.8±1.0	25.5±2.9	49.0±4.9

Apply 80% torque when tightening bolts to aluminium alloy.

6.3.2 Adjusting valve clearance and retightening the cylinder head bolts.

Both procedures have to be carried out with a cold engine. When both procedures are carried out be sure to retighten the cylinder head bolts before adjusting the valve clearance. First remove the valve cover.
Loosen the bolts slightly, remove the rocker assembly (the rocker arms, shaft, and stays) and then retighten the bolts to the specified torque in the numerical order illustrated (ref. to fig. 15).

6.3.3 Tightening torques:

Cylinder head screws M9x1,5:
47 to 51 Nm;.
Rocker arm bracket mounting: M6 x 1:
10 to 12 Nm;

6.3.4 Valve clearance

Remove the valve cover.
When the engine is in cold condition both valves should have a clearance of 0.15 ± 0.03. The adjustment has to be done at T.D.C. of the compression stroke. Using a pocket light one can check the position of the flywheel/alternator (refer to picture 14). By using the decompression handle one can crank the engine easily with a screwdriver (clockwise) pushing the starter gear to put the marks in line. Confirm that the valves do not move up or down when the crankshaft is turned about 20 degrees in normal and reverse direction of rotation. If the rocker arms move the piston is on the T.D.C. of the intake or exhaust stroke. In such a case turn the crankshaft 360° in the direction of engine rotation again. The piston is now at T.D.C. of the compression stroke. After readjustment one should crank the engine for 20 rotations and check the valves again.

(When one cannot see the mark on the flywheel/ alternator, the TDC can be found by rotating the flywheel and watching each valve to open and close. Rotate the flywheel clockwise, allowing the exhaust valve to open and close and the intake valve to open and close. After the intake valve has closed, rotate the flywheel clockwise an additional ¼ turn. At this position the piston will be on compression stroke And both valves will be closed allowing valve clearance adjustment to be completed.)

Before closing the valve cover apply some oil to the contact surface between the adjusting screw and push rod. Use a new valve cover gasket.

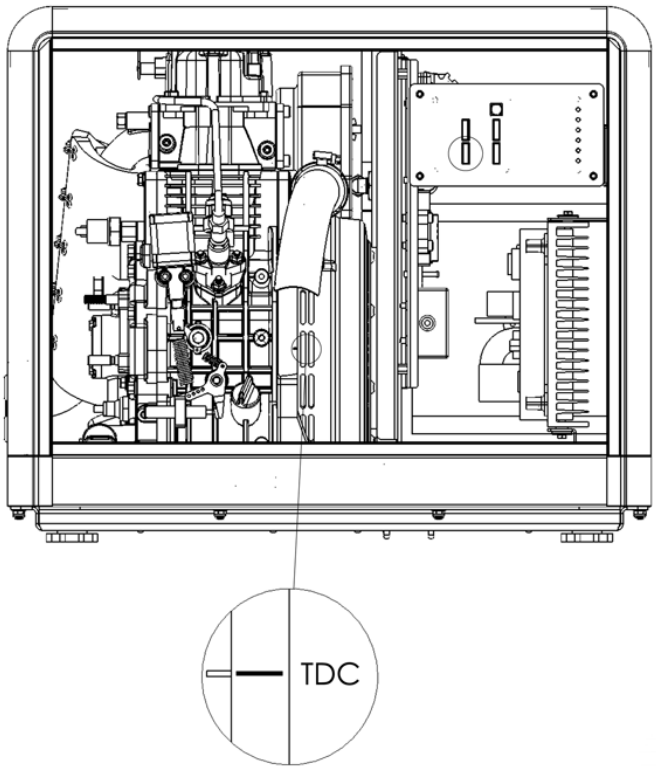


Fig. 14: Valve clearance

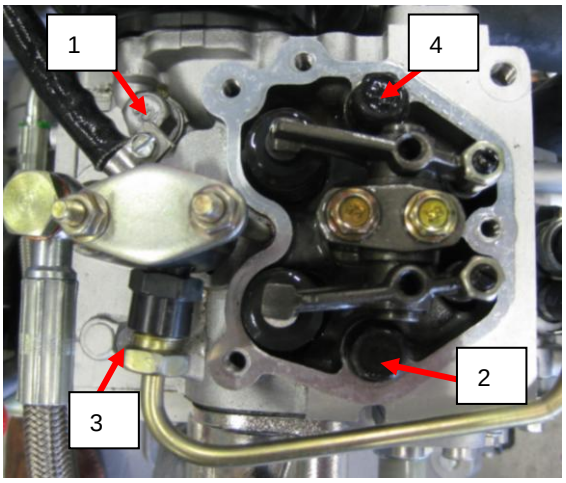


Fig. 15: Cylinder head bolts.

6.4 Disassembly instructions

It could be necessary to disassemble the Genverter for repair or checks. Following instructions will help:

1 The design of the W-GV4 makes it possible to do most repairs on the spot.
2 The sound shield can be disassembled according to exploded view below.
3 To take the Genverter out of the canopy all hose and cable connections have to be taken off.
4 The exhaust pipe has to be removed as well.
5 The set is fixed to its base by four rubber mountings and can be loosened by removing the four nuts that hold the engine on the brackets inside the canopy. The easiest way to get the Genverter out of its capsule is by lifting the genverter with the aid of the lifting eyes.
6 One can take off the alternator cover. When removing the rotor; special tooling is recommended to work against the strong forces of the magnets. One should care not to damage the magnets.
7 Reassembling the Genverter one should take care of alignment, cleaning the surfaces between engine and alternator and tighten the bolts crosswise and gradually.
8 Reassembling the rotor one should be very careful as the strong magnets will pull the rotor on its place what could damaged the magnets OR HURT YOUR FINGERS.
9 Use Loctite 577 to seal the fittings, which should first be cleaned and made free of oil and grease.
10 Test the Genverter first outside its capsule and check very carefully for leakages before putting it back in its enclosure.

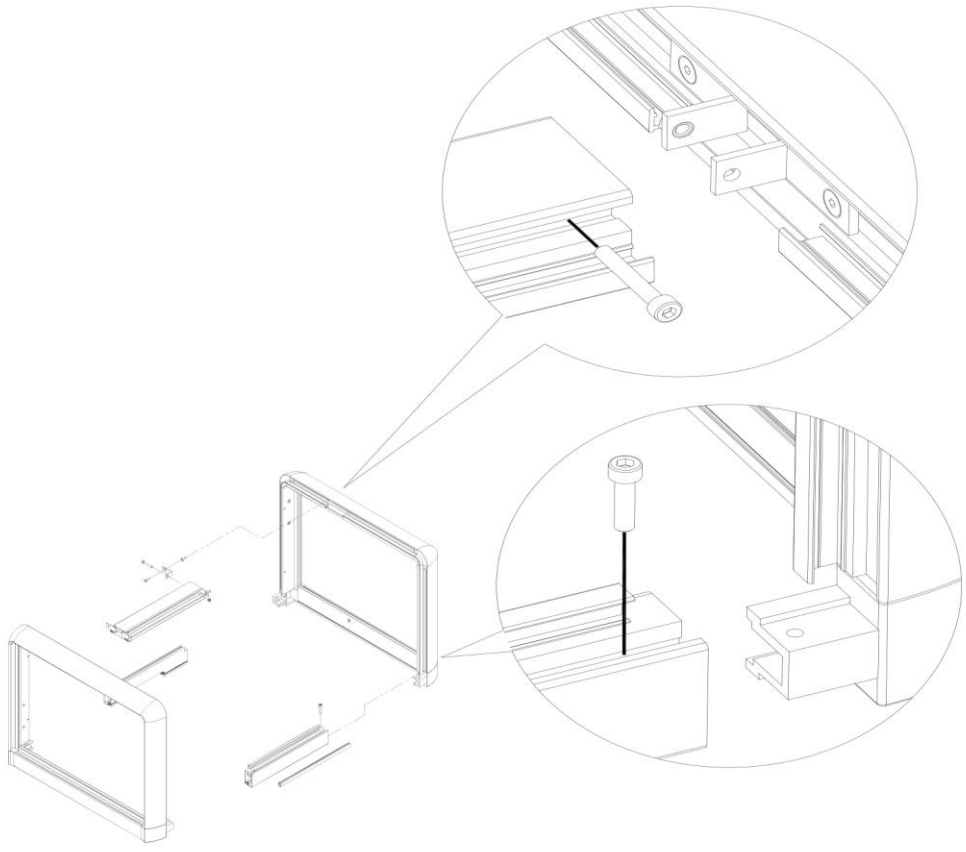


Figure 15: exploded view sound shield W-GV4

7 SPARE PARTS LIST

A complete parts manual in English is available as an option number: number: 40200144
A work shop manual in English is available as an option number: 40200146).

We recommend the following spares for service and maintenance.

- Kit A GV4: parts for regular maintenance parts marked (*) article no. 40201160
- Kit B GV4: parts for maintenance + spare parts: all parts marked (*)+(**) article no. 40201161

ARTICLE NO	DESCRIPTION
40209030	Fuel filter (*)
50201060	Fuel lift pump (**)
40401329	Air filter element(*)
40201340	Oil strainer (**)
50209236	Lube oil pressure switch
50209239	Cooling oil pressure switch (**)
50209219	Temperature sensor (**)
40401101	Battery charger
40401095	12V Ventilator (**)
40401062	PCB Local control panel
40401150	Digital Diesel Control Unit
40209102	Digital Diesel Remote control panel
50212171	Fuses 15 Amps(*)
50212170	Fuses 10 Amps(*)
50212155	Fuses 5 Amps (*)
50212154	Fuses 3 Amps (*)
40401060	Wiring loom complete
50209136	Cable remote control 10 mtr, including connectors
40201202	Valve cover gasket (*)
40401221	Cylinder head gasket
40401392	Cylinder head gasket kit
40401391	Overhaul gasket kit / Seal kit (**)
40401020	Actuator assy inc. brass spindle (**)
40401385	Injector assy (**)
40401381	Fuel pump (high pressure) complete
40401240	Solenoid fuel pump (**)
40401386	Starter motor 12V
40401018	Oil pipes and fittings kit
40401031	Fuel hose kit

MAINTENANCE LOG

first service after 50 hours:	hour counter:	remarks
next service (every 150 hours)	hour counter:	

EC Declaration of Conformity/Incorporation

In accordance with EN ISO 17050-1:2004

We Whisper Power BV, Kelvinlaan 82, 9207 JB Drachten, The Netherlands
in accordance with the following Directive(s,

2006/95/EC The Low Voltage Directive
2004/108/EC The Electromagnetic Compatibility Directive
2004/104/EC The Automotive EMC Directive
2004/26/EC The Non Road Exhaust Emission Directive

hereby declare that:

GENVERTER W-GV4

Model number: All models
Serial Number: All serial numbers

are in conformity with the applicable requirements of the following documents:

Ref. No.	Title
EN 60950	Low voltage standard
EN 61000-6-3	Generic Emission Standard
EN 61000-6-1	Generic Immunity standard

We hereby declare that the equipment named above has been designed to comply with the relevant sections of the above referenced specifications and are in accordance with the requirements of the Directive(s)

In accordance with the following Directive:

2006/42/EC The Machinery Directive

Standards applied:

ISO 14121-1	Risk Assessment
EN 292-1-2	Safety of Machinery, Basic concepts general principles of design
EN 842: 1996+A1	Visual Danger Signals

the machinery is incomplete and must not be put into service until the machinery into which it is to be incorporated or the vehicle into which it is to be installed, has been declared in conformity with the provisions of the Directive.

We undertake to transmit, in response to a reasoned request by the appropriate national authorities, relevant information on the partly completed machinery identified above.

Signed by:

Name: Dr. R.E.Bosman,

Technical Director,
Drachten
Date: August 30th 2010

Document ref. No. 2010-Mobile-W-GV4

The technical documentation for the machinery is available from:
Whisper Power BV,
Kelvinlaan 82, 9207 JB Drachten , The Netherlands

Kelvinlaan 82, 9207 JB Drachten, The Netherlands
Tel : + 31-512-571550 / Fax : + 31-512-571599
www.whisperpower.eu / info@whisperpower.nl